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# Optimism and pessimism are related to different components of the stress response in healthy older people

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ABSTRACT

Some personality traits have key importance for health because they can affect the maintenance and evolution of different disorders with a high prevalence in older people, including stress pathologies and diseases. In this study we investigated how two relevant personality traits, optimism and pessimism, affect the psychophysiological response of 72 healthy participants (55 to 76 years old) exposed to either a psychosocial stress task (Trier Social Stress Test, TSST) or a control task; salivary cortisol, heart rate (HR) and situational appraisal were measured. Our results showed that optimism was related to faster cortisol recovery after exposure to stress. Pessimism was not related to the physiological stress response, but it was associated with the perception of the stress task as more difficult. Thus, higher optimism was associated with better physiological adjustment to a stressful situation, while higher pessimism was associated with worse psychological adjustment to stress. These results highlight different patterns of relationships, with optimism playing a more important role in the physiological component of the stress response, and pessimism having a greater effect on situational appraisal.



## 1. Introduction

Throughout life, people have to deal with psychosocial stressors from many sources and with different durations. The sympathetic nervous system (SNS) and the hypothalamus–pituitary–adrenal (HPA) axis, which regulates cortisol release, are activated in response to physical and psychological stressors (Dickerson and Kemeny, 2004; Kudielka et al., 2004b). Moreover, psychological (e.g. increases in state anxiety and negative affect) and behavioral (such as displacement and submissive behaviors) changes are also associated with acute stress exposure (Villada et al., 2014a, 2014b). In their meta-analysis, Chida and Steptoe (2010) concluded that greater cardiovascular (CV) reactivity to and poor recovery from acute stress are related longitudinally to unwell/unsatisfactory CV status. They reported that higher future blood pressure was associated with greater reactivity and poor recovery, although other CV alterations were related differently, thus contributing to an increased future CV risk status.

Some age-related changes in the stress response have been reported, as older people show higher stress-induced cortisol release (Almela et al., 2011b; Otte et al., 2005), higher sympathetic tone (Almela et al., 2011b), a decline in autonomic regulation of cardiac dynamic capacity (Laitinen et al., 2004) and changes in emotional regulation (Carstensen et al., 1999; Mather and Carstensen, 2005), all of which may affect the ability to cope with stress (Pardon, 2007). However, aging is only one of many factors that can affect the stress response. In fact, consistent individual differences in stress systems have been reported (Lovallo, 2011).

Individual personality differences are related to differences in stress perceptions (Connor-Smith and Flachsbart, 2007), which can also affect the biological stress systems (Carver and Connor-Smith, 2010; Dickerson and Kemeny, 2004). Chida and Hamer (2008) concluded that negative psychological states, i.e. anxiety and hostility, are related to higher CV response and poorer recovery after stress, while positive psychological states or traits (e.g. happiness and self-enhancement) are associated with reduced HPA axis reactivity. Given the important relationship between the acute stress response and health, the study of stress-related factors that can modulate this relationship acquires great relevance, especially in the most vulnerable life periods, such as old age. Specifically, interest in the relationship between personality characteristics and physical health has increased considerably in the past few decades (Rasmussen et al., 2009).

Optimism, a very influential trait in the way people perceive and conduct their lives (Carver et al., 2010), has been related to wellbeing and several stress-related diseases, such as metabolic syndrome (Cohen et al., 2010; Roy et al., 2010), cancer (Friedman et al., 1992; Rajandram et al., 2011) and cardiovascular diseases (Nabi et al., 2010; Tindle et al., 2010). One of the most widely used questionnaires to measure optimism is the "Life Orientation Test" (LOT) (Scheier and Carver, 1985), which was later revised (LOT-R) (Scheier et al., 1994). The LOT-R measures dispositional optimism, which involves generalized outcome expectancies. Originally, it was considered to be one-dimensional, with optimism and pessimism at opposite poles that showed a strong negative correlation in young people (Scheier and

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Carver, 1985). Thus, optimistic people tend to have positive generalized expectations about their future, while pessimists have negative expectations (Scheier and Carver, 1992; Scheier et al., 1994). However, other studies in middle-aged and older people revealed low shared variance between optimism and pessimism (Mroczek et al., 1993; Plomin et al., 1992; Robinson-Whelen et al., 1997), leading to their consideration as independent factors. Some theoretical formulations (Diener et al., 1999; Ryff and Singer, 1998) defended the independence of positive and negative mental states, based on several studies that reported this independence (e.g. Lai, 1994, 1997; Lai et al., 2005). Other authors have proposed that this age-related difference may be due to changes in metacognitive beliefs about optimism and pessimism, allowing people to adaptively use either of them to cope in different situations (Herzberg et al., 2006).

Research focusing on the relationships between optimism and the physiological stress response to acute stress is sparse and has shown mixed results. In young adults, Solberg Nes et al. (2005) reported an increased cortisol and HR response in participants who scored higher on dispositional optimism and self-consciousness. Moreover, Brydon et al. (2009) observed faster cortisol recovery after stress in young men with more dispositional optimism. These results suggest that the presence of optimistic beliefs affects HPA and sympathetic activity, along with self-consciousness, highlighting the protective role of optimism, given that slower recovery after stress can have negative health consequences (McEwen, 1998; Sapolsky et al., 2000). Therefore, optimism has been considered positive in the long run, given that, as behavioral self-regulation theory establishes (Carver and Scheier, 2000), an optimistic assessment of the situation produces confidence and facilitates the capacity to maintain an effort to achieve goals, increasing positive affect and wellbeing (Solberg Nes et al., 2005). By contrast, negative evaluations would increase a sense of doubt and facilitate the removal and disengagement impulse, reducing behaviors of effort (Carver and Scheier, 2000). Previous studies showed that optimism is related to better goal-readjustment (Aspinwall and Richter, 1999; Duke et al., 2002), which raises the hypothesis that the relationship between optimism and a person's quality of life depends on reengaging in new goals when valuable goals become unreachable (Rasmussen et al., 2006). Thus, the way people generate expectations would affect the perception of the situation, which in turn would have an influence on the psychophysiological response to acute stress.

However, this possible effect of optimism on the acute stress response has hardly been studied in older people. To the best of our knowledge, only one study has examined this relationship. Endrighi et al. (2011) analyzed the relationship between dispositional optimism and the cortisol awakening response (CAR), daily cortisol release and stress-induced cortisol release after exposure to two laboratory stress tasks (computerized color–word and mirror tracing task) in older people. These authors observed lower CAR in optimists, suggesting that dispositional optimism may have a protective role. However, unlike the studies with young people mentioned above, they did not observe significant relationships between dispositional optimism and acute stress-induced and daily cortisol release in older people. Thus, optimism seems to have a relationship with HPA-axis activity in older people, but not specifically with the stress-induced cortisol response. However, it should be noted that in this study, the authors considered dispositional optimism, and not optimism and pessimism separately, which seem to be different dimensions in older people (Herzberg et al., 2006). Thus, it would be advisable to consider them as two separate dimensions in order to more closely examine the relationships among optimism, pessimism and the stress response in older people.

With this in mind, the purpose of this study was to investigate how optimism and pessimism are related to the HPA and HR response, as well as situational appraisal, in a situation of acute social stress in older people. Healthy volunteers from 55 to 76 years old were exposed to a psychosocial stressor (Trier Social Stress Test, TSST) or a control task in order to study their stress-induced cortisol, heart rate (HR) response and situational appraisal. Based on previously mentioned results, we expected a positive relationship between optimism and HPA and HR reactivity (Solberg Nes et al., 2005), but also faster recovery (Brydon et al., 2009) after the stressful task, given that more optimistic people are better able to manage stress and overcome it successfully (Carver et al., 2010). On the other hand, we expected a negative relationship between pessimism and HR and cortisol recovery from the acute stress. Some authors have suggested that the stress response depends greatly on the way the event is interpreted (Salvador and Costa, 2009), so that the situational appraisal gains importance. Coinciding with Endrighi et al. (2011) we expected lower stress perceptions in optimistic people exposed to stress, as well as higher stress perceptions in pessimistic people. Additionally, in order to better understand the effect of these personality traits on the perception of the situation, we explored the effect of optimism and pessimism traits on the perception of how difficult, frustrating or important the stress task was, and how much effort it required.

## 2. Material and methods

### 2.1. Participants

For subject recruitment, informative advertisements were displayed on the University campus, especially directed to students of La Nau Gran, a study program for people over 55 years old. The exclusion criteria were: smoking over 10 cigarettes a day, abuse of alcohol or other drugs of abuse, severe vision or hearing problems, presence of severe CVD, an illness that involves HPA disturbance, and neurological or psychiatric disorders. Subjects were also excluded if they were being medicated with drugs related to cognitive or emotional functions, or with an influence on hormonal levels or cardiovascular function (such as glucocorticoids or b-blockers), or if they consumed psychotropic substances. All the female participants were postmenopausal, and none of them were receiving estrogen replacement therapy. Subjects who met the criteria were contacted by telephone and asked to participate in the study.

The final sample was composed of 72 participants randomly assigned to two conditions: 38 to the stress condition (19 men) and 34 to the control condition (17 men). 87.5% of the participants were students in the La Nau Gran program, and 12.5% were referred by these students (acquaintances, relatives or friends).

The study was performed according to the Declaration of Helsinki, and the Ethics Committee of the university approved the protocol. All participants received verbal and written information about the study, signed an informed consent form, and received a gift worth 15€ for their collaboration.

### 2.2. Procedure

In this study, each subject participated in an individual session lasting approximately 1 h and 30 min (between 16 and 20 h) in a laboratory at the School of Psychology. Upon their arrival at the laboratory, the height and weight of the participants were measured in order to calculate the body mass index (BMI), and the experimenter verified that they had followed the instructions given previously: sleep as long as usual, refrain from heavy activity the day before, and not consume alcohol since the night before. Additionally, they were instructed to drink only water and not eat, smoke or take any stimulants 2 h prior to the session.

#### 2.2.1. Stress condition

We employed the Trier Social Stress Test (TSST, Kirschbaum et al., 1993; Kudielka et al., 2007) to provoke cortisol and cardiovascular responses (Almela et al., 2011a, 2011b; Hidalgo et al., 2012). The task consisted of 5 min of free speech (job interview) and a 5 min arithmetic task (serial subtraction), performed in front of a committee composed of a man and a woman. Interactions with participants were always